WHAT IS CLAIMED IS:

1.   A method to create a digital model of a patient's teeth, comprising:

creating an impression of the patient's teeth;

scanning the impression using an X-ray source; and

generating the digital model with scanned data.

2.   The method of claim 1, further comprising using passing the radiation source through a scintillator.

3.   The method of claim 2, further comprising digitizing the output of the scintillator.

4.   The method of claim 1, wherein the impression of the teeth is taken in a plastic tray.

5.   The method of claim 1, further comprising taking a bite impression of the patient.

6.   The method of claim 5, wherein the bite impression is taken using a PVS material.

7.   The method of claim 5, wherein the bite impression is taken using a wax bite.

8.   The method of claim 1, wherein an upper teeth impression, a lower teeth impression and a bite impression is scanned together.

9.   The method of claim 8, further comprising digitally reversing data from the upper and lower impression scan data to make positive data.

10.   The method of claim 9, wherein the digital reversing identifies inner surfaces of an impression material and extracting the inner surfaces using a largest connected component algorithm.

11.   The method of claim 1, further comprising aligning data into a bite position using the bite material scanned.

1 12. The method of claim 1, further comprising digitally detailing the teeth
2 data.

1 13. The method of claim 1, further comprising setting a final bite.

1 14. The method of claim 1, further comprising articulating the digital
2 model.

1 15. The method of claim 1, further comprising treating a patient using the
2 digital model.

1 16. The method of claim 1, further comprising:
2 generating a computer representation of a masticatory system of the patient;
3 and
4 determining an occlusion from the computer representation of the masticatory
5 system.

1 17. The method of claim 16, wherein the occlusion is a static occlusion,
2 further comprising:
3 modeling an ideal set of teeth;
4 automatically applying the ideal set of teeth to the computer representation of
5 a masticatory system of the patient; and
6 optimizing the position of the patient's teeth to fit the ideal set of teeth.

1 18. The method of claim 17, wherein the modeling step further comprises
2 selecting one or more arch forms specifying the ideal set of teeth.

1 19. The method of claim 17, wherein the masticatory system includes jaws
2 and wherein the applying step includes:
3 registering a model of the upper and lower teeth with a model of the
4 masticatory system;
5 simulating the motion of the jaws to generate contact data between the upper
6 and lower teeth; and
7 placing a tooth in a final position based on the contact data.

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1   20.   The method of claim 19, wherein the model is registered using X-ray

2 data.

1   21.   The method of claim 19, wherein the model is registered using

2 computed tomography data.

1   22.   The method of claim 19, wherein the model is registered using data

2 associated with a mechanical model.

1   23.   The method of claim 19, wherein the simulating step further comprises

2 applying kinematics to the model of the teeth.

1   24.   The method of claim 19, wherein the simulating step further

2 comprises applying a constrained motion to the model of the tooth.

1   25.   The method of claim 19, wherein the placing step is based on a

2 measure of undesirability to the contacts.

1   26.   The method of claim 25, further comprising optimizing the position of

2 the tooth according to the measure of undesirability.

1   27.   The method of claim 26, further comprising minimizing the measure of

2 undesirability.

1   28.   The method of claim 27, wherein the measure of undesirability is a

2 function of one or more of Peer Assessment Rating (PAR) metrics, distance-based metrics

3 and shape-based metrics.

1   29.   The method of claim 17, wherein the simulating step includes

2 providing a library of motions.

1   30.   The method of claim 29, wherein the library of motions includes a

2 protrusive motion.

1   31.   The method of claim 29, wherein the library of motions includes a

2 lateral motion.

1   32.   The method of claim 29, wherein the library of motions includes tooth-
2   guided motions.

1   33.   The method of claim 17, wherein the simulating step includes applying
2   physical forces to one jaw.

1   34.   The method of claim 17, wherein the placing step further includes
2   updating the computer representation of the masticatory system with new patient data.

1   35.   The method of claim 34, wherein the patient has a first teeth model,
2   further comprising:
3   scanning the teeth of the patient to generate a second teeth model;
4   matching the second teeth model with the first teeth model;
5   applying a final position transform to the second teeth model; and
6   adjusting the position of teeth in the second model based on new information.

1   36.   An apparatus to create a digital model of a patient's teeth, comprising:
2   a radiation source;
3   a scintillator to receive the radiation from the radiation source;
4   a radiation detector coupled to the scintilllator;
5   a rotatable table positioned between the radiation source and the scintillator,
6   the table being adapted to support an impression of the patient's teeth; and
7   a computer coupled to the detector to generate the digital model with scanned
8   data.

1   37.   The apparatus of claim 36, wherein the radiation source is an X-ray
2   source.

1   38.   The apparatus of claim 36, wherein the radiation source is a computed
2   tomography source.

1   39.   The apparatus of claim 36, wherein the rotatable table is adapted to
2   support an upper teeth impression, a lower teeth impression and a bite impression.

1   40.   The apparatus of claim 36, further comprising a fabrication machine
2   coupled to the computer to generate a plurality of appliances, wherein the appliances

3   comprise polymeric shells having cavities and wherein the cavities of successive shells have

4   different geometries shaped to receive and resiliently reposition the teeth from one

5   arrangement to a successive arrangement.